Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Amendment of the Commission's Policies and	)	
Rules for Processing Applications in the	)	IB Docket No. 06-160
Direct Broadcast Satellite Service	)	
	)	
Feasibility of Reduced Orbital Spacing for	)	
Provision of Direct Broadcast Satellite Service	)	Report No. SPB-196
in the United States	)	

REPLY COMMENTS
OF ECHOSTAR SATELLITE L.L.C.

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SUMMARY

The Commission should not view the tweener proceeding in a vacuum. If the objective of this proceeding is to provide existing and new DBS providers with expanded spectrum capacity, commenters have demonstrated that this proceeding is a poor vehicle to achieve that goal. There are a number of alternative spectrum options – including Reverse Band Working, CARS, and Ka-Band spectrum – that would achieve this objective in a more straightforward, spectrally efficient, and less controversial manner.

With respect to the feasibility of tweener satellites, the most effective means to ensure that both incumbent and tweener DBS operators receive sufficient interference protection to provide viable commercial offerings is to rely on the results of operator-to-operator agreements. All tweener applicants should be required to coordinate with existing U.S. DBS operators regardless of ITU interference triggers, which have proven inadequate.

Nonetheless, if the Commission were to move forward and adopt its own interference benchmarks for tweener operations, it should do so in a manner reflective of real world DBS operations and corresponding operational constraints. To date, however, proponents of tweener satellites support interference parameters based on inaccurate assumptions: each of the distinct tweener-backed interference criteria – the ITU degradation criterion, 10 percent unavailability increase, or 19 dB carrier-to-interference (C/I) level – is flawed in this case, and cannot protect adequately DBS operators and their tens of millions of customers. The same infirmities are present in tweener-backed calls for "symmetry" in regulation between existing and tweener satellites, which could result only in asymmetrical burdens unreasonably favoring tweener operations that have no established customer base.

At a minimum, the Commission should explore two inherent characteristics of the DBS service, that are largely absent from comments filed by tweener proponents, before adopting any final requirements. First, at its core, DBS is a residential service with millions of small dishes throughout the country that cannot be magically converted into larger dishes, or automatically corrected for antenna mispointing. It is well-established that any mandated changes to residential customer dish configurations would require substantial consumer inconvenience as well as a resource-intensive and cost-prohibitive truck roll to every customer's home and even additional subscriber equipment costs.

Second, the Commission has already authorized two other services to operate and cause interference in the DBS band. Any further interference to existing DBS operations must reflect the multiple sources of interference previously permitted, and should not provide for a disparate snowball effect on existing DBS operations.

Nor can broader video competition issues be set to the side in this review of appropriate interference standards. Terrestrial video providers continue to expand their channel capacity and advanced service offerings, including High Definition and Video-on-Demand services. Since their inception, DBS providers have greatly expanded the power of DBS satellites and incorporated more spectrum intensive technologies – *e.g.*, spot beam technology, compression technologies, advanced modulation and coding – to try to keep pace. The Commission should, therefore, be leery of any tweener proposal that inhibits the ability of existing providers to continue to improve current services or create new services from existing orbital locations to match terrestrial competitive developments. The Commission should similarly be skeptical of any reforms that could reduce the reliability or availability of DBS service. Cable providers already disparage the "spotty service" of satellite services, and any further FCC-sanctioned

decrease in reliability would be an immediate consumer issue. Again, it appears that proponents of tweeners thus far have ignored the broader competitive implications of this proceeding.

Any final licensing and processing rules should ensure that applicants have the financial wherewithal and resources to construct and deploy high-powered expensive DBS satellites in a timely manner. It is of paramount concern that limited spectrum resources are not warehoused or misused for speculative purposes. In addition, both incumbent and existing providers should have full access to available spectrum in an equitable manner upon the lifting of the DBS freeze, and a clear process should be established so all interested parties have fair access.

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EchoStar Satellite L.L.C. ("EchoStar") hereby submits its reply comments on the Notice of Proposed Rulemaking issued by the Commission in the above-captioned proceeding ("*DBS NPRM*").[1]

I. THE COMMISSION SHOULD FIRST AGGRESSIVELY EXPLORE OTHER OPTIONS FOR INCREASING MVPD COMPETITION

The technical constraints necessary to introduce tweener satellites without harmful interference would almost certainly weaken the ability of the entire Direct Broadcast Satellite ("DBS") industry (including the new tweener entrants themselves) to compete with terrestrial providers in the multichannel video programming distribution ("MVPD") market. The Commission should make no mistake about the competitive repercussions of allowing tweener

[1] *Amendment of the Commission's Policies and Rules for Processing Applications in the Direct Broadcast Satellite Service; Feasibility of Reduced Orbital Spacing for Provision of Direct Broadcast Satellite Service in the United States*, FCC 06-120, Notice of Proposed Rulemaking, 21 FCC Rcd 9443 (2006) ("*DBS NPRM*"). The *DBS NPRM* was published in the Federal Register on September 28, 2006. *See* 71 Fed. Reg. 56,923 (2006). A supporting Technical Annex prepared by Dr. Richard Barnett is attached as Exhibit 1.

operations. SES Americom, Inc. ("SES"), is candid in requesting that the Commission adopt rules that would entail the phasing out of small dishes.[2] ManSat Ltd. ("ManSat"), SES, and Spectrum Five, LLC ("Spectrum Five") similarly request that the Commission step in to require existing DBS providers to agree to constrain their operations.[3] The Commission should swiftly reject any calls for regulatory intervention, which would second-guess consumer preferences for small dishes, high quality of reception, and an increasing variety of programming.

Nonetheless, some commenters invoke the hope of increased competition in the MVPD market as the main reason why the Commission should hasten to allow "tweener" satellite operations in the 12 GHz DBS band.[4] There are, however, less restrictive means for ushering in more MVPD competition without disrupting the service enjoyed today by over 28 million households. Such means – underused frequencies outside the 12.2-12.7 GHz band – are readily available to the Commission and are more likely to allow interference-free MVPD service than shoehorning additional slots into the high-power DBS arc.

Specifically, the Commission should thoroughly explore the availability of other bands for multichannel video by satellite. The Commission should not conclude this rulemaking

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[2] Comments of SES Americom, Inc., at 16, *filed in* IB Docket No. 06-160 (filed Dec. 12, 2006) ("SES Comments") ("Accordingly, we propose that antennas as small as 45 cm be entitled to interference protection for networks operating at orbital locations assigned to the U.S. under the Region 2 Plan, *until these antennas are phased out of service due to the increasing deployment of multibeam antennas of larger diameter (52 cm and larger).*") (emphasis added).

[3] Comments of ManSat Ltd at 8-10, *filed in* IB Docket No. 06-160 (filed Dec. 12, 2006) ("ManSat Comments"); SES Comments at 19-20; Comments of Spectrum Five, LLC, at 7, *filed in* IB Docket No. 06-160 (filed Dec. 12, 2006) ("Spectrum Five Comments").

[4] *See* Comments of Government of Bermuda at 2, *filed in* IB Docket No. 06-160 (filed Dec. 7, 2006) ("Bermuda Comments"); ManSat Comments at 3; SES Comments at 2; Spectrum Five Comments at 1-3.

before it concludes the Reverse Band Working proceeding.[5] The Commission should also commence the promised proceeding to evaluate the availability of the adjacent 12 GHz Cable Television Relay Service ("CARS") band for DBS service,[6] and grant EchoStar's petition for a rulemaking to allow the unused Ka-band spectrum reserved for non-geostationary satellite orbit ("NGSO") Fixed Satellite Service ("FSS") to be used for geostationary FSS.[7] Each of these options holds promise as a future home for satellite MVPD competitors.

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[5] *See Establishment of Policies and Service Rules for the Broadcasting-Satellite Service at the 17.3-17.7 GHz Frequency Band and at the 17.7-17.8 GHz Frequency Band Internationally, and at the 24.75-25.25 GHz Frequency Band for Fixed Satellite Service Providing Feeder Links to the Broadcasting-Satellite Service and for the Satellite Services Operating Bi-directionally in the 17.3-17.8 GHz Frequency Band*, FCC 06-90, Notice of Proposed Rulemaking, IB Docket No. 06-123 (rel. Jun. 23, 2006) (proposing rules for Broadcasting-Satellite Service ("BSS") in the reverse-band working mode in the 17/24 GHz bands).

[6] *See Amendment of Eligibility Requirements in Part 78 Regarding 12 GHz Cable Television Relay Service*, 17 FCC Rcd 9930, at ¶ 44 (2002) ("*CARS Order*"). The 12 GHz CARS band (12.7 GHz to 13.2 GHz) has the same propagation characteristics as the "next-door" DBS spectrum. Equipment using the band is readily available. Moreover, the spectrum is already allocated FSS uplinks. *See* 47 C.F.R. § 2.106. Importantly, the Commission has recognized the merit of EchoStar's views. In its 2002 CARS Report and Order, the Commission stated: "Notwithstanding that EchoStar's proposal for DBS use of the 12 GHz CARS band . . . raise[s] valid issues regarding the applicability of flexible use policies to the 12 GHz band, which we intend to address in a separate proceeding." *CARS Order* at ¶ 44.

[7] EchoStar Satellite L.L.C., Petition for Rulemaking to Redesignate the 28.6-29.1 GHz (Earth-to-space) and 18.8-19.3 GHz (space-to-Earth) Bands to Allow Geostationary Fixed-Satellite Service Operations on a Co-Primary Basis, *filed in* RM No. 10767 (filed Aug. 28, 2003) ("EchoStar Ka-band Petition"). The Ka-band frequencies, too, can be deployed effectively for direct-to-home services. The proof is in DIRECTV's platform for the provision of high-definition ("HD") programming, which consists of two Ka-band satellites at the 99° and 103° W.L. orbital locations. DIRECTV's successful use of Ka-Band spectrum to provide DBS services should address fully SES's apparent concerns about the viability of Ka-Band service. SES Comments at 5-6. In addition, the NGSO FSS Ka-band frequencies still lie unused.

II. TWEENER APPLICANTS SHOULD BE REQUIRED TO COORDINATE WITH EXISTING DBS OPERATORS WITH SATELLITES LESS THAN 9 DEGREES AWAY

If the Commission were to proceed with reduced DBS spacing, it should protect the U.S. DBS services received by millions of subscribers by imposing a separate and distinct obligation on tweener applicants to coordinate with existing U.S. DBS operators with satellites less than 9 degrees away, regardless of the degradation in overall equivalent protection margins ("OEPMs") that may be caused by the tweener satellite.

Commenters such as ManSat, SES and Spectrum Five ask the Commission to constrain the flexibility of the DBS operators to protect their interests and those of their subscribers.[8] These requests for regulatory interference into private operator-to-operator coordination are effectively no different than SES's call for a mandatory phasing out of small dishes. They both urge the Commission to apply industrial policy based on what the regulator views as "good enough" for consumers, not what market forces have determined.

Coordination can only function to protect DBS operations if the parties are free to press their interests during such negotiations. Thus, the Commission should not intervene by setting a time limit for the resolution of negotiating impasses, nor should it establish technical criteria for their resolution. Rather, it should adhere to the "long-standing Commission policy not to involve itself with private contract disputes."[9] Further, intervention to force agreement

[8] ManSat Comments at 7-8; SES Comments at 14-20; Spectrum Five Comments at 3-7.

[9] *See Verestar, Inc. (Debtor-In-Possession) and SES Americom, Inc.*, 19 FCC Rcd 22750, at ¶ 16 (2004) (citing *MCI Telecomms. Corp. and EchoStar 110 Corp.*, 16 FCC Rcd 21608, at ¶ 30 (1999); *O.D.T. International*, 9 FCC Rcd 2575, at ¶ 9 (1994) (Commission has consistently held that it is not the proper forum for resolving contractual matters); *Loral Corporation, Request for Declaratory Ruling Concerning Section 310(b)(4) of the Communications Act of 1934*, 12 FCC Rcd 21164 at ¶13 (1997)*; Bank America & SA and Customtronics*, 16 FCC Rcd 15772, 15773 P5 (2001) (declining to address merits of a petition in light of the Commission's long-standing policy of repudiating involvement in contractual disputes)).

from a U.S licensee would subvert treaty role of the United States government as a champion of the U.S. licensees in Administration-to-Administration talks.

The commenters are also wrong that the DBS operators would have no incentive to reach agreement absent regulatory intervention. Such concerns are speculative and without foundation: EchoStar is more than willing to entertain any tweener proposal that ensures protection of its operations going forward. Indeed, EchoStar has an interest in coordinating its own proposed tweener satellite with Telesat Canada – although EchoStar believes that coordination will be much easier in that case because of the satellites' different geographic coverage. Ironically, it is Spectrum Five that has made no attempt to coordinate with EchoStar in the two years since it first filed petitions for tweeners at 114.5° W.L.[10]

III. ROBUST TECHNICAL CRITERIA ARE REQUIRED TO PROTECT THE U.S. DBS SERVICES RECEIVED BY MILLIONS OF CONSUMERS

If the Commission were to intervene in the coordination process – which it should not – it should establish robust technical criteria to protect the U.S. DBS services received by millions of consumers from tweener DBS satellites operating less than 9 degrees away, and to preserve the ability of existing U.S. DBS operators to innovate. As EchoStar has pointed out, the ability to transmit high power signals without harmful interference has been and will remain the key to the DBS operators' ability to innovate and compete in the MVPD market. Good examples of such innovation include the delivery of local-into-local service with spot beam technology, the

[10] Spectrum Five originally filed petitions for a DBS satellite at 114.5° W.L. in December 2004. *See Spectrum Five, LLC*, File Nos. SAT-LOI-20041228-00228 and SAT-LOI-20041228-00229, Call Signs S2649, S2650 (filed Dec. 28, 2004) (dismissed without prejudice, *see* Letter from Fern Jarmulnek, FCC to Todd Stansbury, Counsel to Spectrum Five, DA 05-354 (Feb. 17, 2005)).

triple-feed dish and the in-car mobile DBS devices recently announced by EchoStar and DIRECTV.[11]

The Commission should be careful to ensure that any interference parameters adopted reflect actual DBS operating conditions. In this regard, the criteria offered by tweener proponents are based on fundamental assumptions about DBS service that are inaccurate. Each of the technical criteria put forward by tweener proponents in this proceeding – the ITU degradation criterion, the 10% increase in unavailability standard, and the 19 dB carrier-to-interference (C/I) level – are, therefore, inadequate in this case to protect existing DBS operations. Absent an operator-to-operator agreement, existing DBS services require a minimum C/I of 24 dB (single-entry from each adjacent tweener satellite) based on actual operating conditions.

A. Real-World Antenna Mispointing Should be Reflected in the Interference Analysis

Antenna mispointing is a practical reality of a residential DBS service: professional and do-it-yourself installations must account for topographical features, customer-designated siting locations, and relatively unsophisticated and affordable consumer dishes. Over time, weather and wind are a prime factor in further mispointing.

Thus, contrary to Spectrum Five's and SES's submissions,[12] the issue of consumer antenna mispointing cannot be ignored when assessing the impact of tweener satellites on existing DBS services. This is because (1) the majority of EchoStar's and DIRECTV's

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[11] *See* Press Release, Dish Network, DISH Network(TM) Introduces TV On The Go (Jan. 8, 2007), *available at* http://phx.corporate-ir.net/phoenix.zhtml?c=68854&p=irol-newsArticle&ID=948155&highlight=; Press Release, DIRECTV, DIRECTV Anywhere, Anytime, Anyplace (Jan. 8, 2007), *available at* http://phx.corporate-ir.net/phoenix.zhtml?c=127160&p=irol-newsArticle&ID=948169&highlight=.

[12] Spectrum Five Comments, Technical Exhibit, at 10; SES Comments at 15.

subscriber antennas have pointing errors; (2) the extent of mispointing is in most cases significantly greater than the 0.5° assumed without data by SES and Spectrum Five; and (3) the effect of that mispointing in the presence of two adjacent tweeners is a net gain in interference that is only made worse by antenna mispointing. In this last respect, the cancelling effect of mispointing claimed by SES – whereby an increase in interference from one direction is offset by a reduction in interference from the other direction – is virtually non-existent, as EchoStar's analysis shows. To ignore the extent and effect of mispointing would be to require residential customers and professional installers to go to extreme lengths to compensate for the necessarily inferior pointing accuracy of DBS dishes as compared to, say, a VSAT or other large earth station antenna. In addition, as explained by Dr. Barnett,[13] some of the mispointing is an inevitable corollary of the use of triple feed dishes. These dishes reflect the orbital separation of the satellites in question as seen from an "average" angle from the earth, resulting in mispointing at every location that does not correspond to that angle.

DIRECTV has submitted compelling data that many of the large installed base of DBS subscribers have dishes that are mispointed, in some cases by up to 2.7°.[14] EchoStar's own data, collected using a different methodology, corroborate these findings.[15] In fact, a substantial majority of the antennas sampled by EchoStar and DIRECTV antennas have mispointing errors of significantly more than the 0.5° that SES claims is "typical"[16] – no less than 60% in the case of DIRECTV[17] and no less than 80% in the case of EchoStar.[18]

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[13] *See* Technical Annex at A-15 to A-17.

[14] DIRECTV Comments, Appendix A.

[15] *See* Technical Annex at A-1 to A-17.

[16] SES Comments at 15.

[17] *See* DIRECTV Comments, Appendix A, at 14.

This perennial characteristic of the dish installation process has significant implications for tweener operations. First of all, tweeners can increase interference into any mispointed antenna, not just those that are mispointed along the geostationary arc and in the direction of the tweener**.** Second, the "negligible" "net effect" described by SES – where a mispointing in the direction of one tweener would result in an increase in interference from one but a near-identical decrease in interference from a tweener on the other side – is simply untrue and misleading.[19] Even when there is no mispointing, the mere presence of tweener satellites on both sides of the DBS satellite would increase the interference experienced by the existing DBS satellite. In addition, once mispointing is taken into account, EchoStar's technical analysis demonstrates conclusively that the increase in interference from one tweener is not offset by the decrease in interference from the other. The extra net interference resulting from mispointing (on top of the increase resulting from having tweeners on both sides) is in the order of 1.7 dB at 0.5° of mispointing, 4.6 dB at 1° mispointing, 7.5 dB at 1.5° mispointing, and 10.1 dB for 2° mispointing.[20] Thus, the cancellation effect claimed by SES is non-existent, except perhaps for mispointing levels of around 0.1° or less. As noted above, over 80% of all mispointings are likely to exceed 0.5° in the case of EchoStar.[21]

In sum, in a 4.5-degree spacing environment, these pointing errors would render millions of consumer dishes vulnerable to debilitating interference from tweener satellites. The existing DBS operators cannot reasonably be expected to correct the pointing errors in millions of dishes to accommodate tweener satellites, nor can millions of residential subscribers be

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[18] *See* Technical Annex at A-6.

[19] SES Comments at 15.

[20] *See* Technical Annex at A-12.

[21] *See* Technical Annex at A-6.

expected to make the corrections themselves. Mispointing error is a fact of the current DBS marketplace that the Commission and operators must take into account when assessing the impact of tweeners by prescribing C/I criteria, and how they should be used, that reflect this reality to its full extent, or leave it to operators to use appropriate mispointing numbers in their coordination discussions.

B. The ITU OEPM Degradation Criterion is Inadequate

In its recent tweener orders, the International Bureau adopted the ITU coordination trigger in Appendix 30/30A of the ITU Radio Regulations – *i.e.*, a 0.25 dB reduction in the OEPMs of existing entries in the Region 2 DBS plan – to protect the operations of existing U.S. DBS satellites. In a similar vein, SES has proposed using the same criterion to trigger the application of other technical criteria (specifically, a 19 dB C/I level and a 10% increase in unavailability). As the Commission has acknowledged, however, the ITU criterion suffers from a significant flaw: the higher the interference level initially, the higher the interference level that must be accepted before coordination.[22]

As tweeners are deployed and other sources of interference in the DBS band come on-line, a less than 0.25 dB reduction in OEPMs could result in unacceptable interference to existing DBS systems. Yet no coordination obligation would be triggered. The situation would be made worse if tweener satellites were added in succession to each side of an existing U.S. DBS slot – the second tweener would be able to take advantage of the reduction in OEPMs

[22] *DBS NPRM* at ¶ 45 ("We could use the ITU's approach in resolving cases of disagreement between the applicant and the licensees concerning the acceptability of interference. However, the calculations are difficult and complex and the acceptable C/I levels depend on the reference situation such that, the higher the interference level initially, the higher the acceptable level of interference would be.").

caused by the first tweener. The ITU criterion cannot, by itself, provide adequate or sufficient protection for existing DBS services.

C. A Criterion Based on 10% Increase in Unavailability is No Answer

Both SES and Spectrum Five, have proposed a criterion based on a 10% reduction in unavailability to protect the operations of other DBS satellites.[23] This criterion would produce inadequate protection, however.[24]

First, tweener satellites would be the third class of would-be new services in the 12 GHz DBS band that would each have the authority to increase the unavailability of DBS operations by up to 10%. In this regard, tweener proponents have ignored all of the other sources of interference with which DBS operators will soon have to contend in the 12 GHz DBS band – co-frequency multichannel video distribution and data service ("MVDDS") operations and NGSO FSS operations. In 2004, the Commission licensed ten companies to provide MVDDS service. As recently as last month, the Commission authorized an NGSO FSS system to operate in the Ku-band.[25]

Ku-band NGSO and MVDDS are both subject to variants of the 10% unavailability criteria. This means that, in each case, the DBS operator has to suffer a 10% decline in availability from the particular source of interference. The effect of these sources is thus cumulative, and results in far greater than a 10 percent unavailability increase in the aggregate. Nor is it possible for the Commission to make the 10% unavailability increase into an aggregate ceiling. To do this, the Commission would have to take away some of the

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[23] SES Comments at 18; Spectrum Five Comments at 4-7.

[24] *See* Technical Annex at A-22.

[25] *Virtual Geosatellite, LLC*, DA 06-2560, Order and Authorization, File Nos. SAT-LOA-19990108-00007, SAT-AMD-20020916-00173, SAT-AMD-20041222-00227; SAT-AMD-20051118-00242; Call Sign S2366 (rel. Dec. 21, 2006).

unavailability increase that others – Ku-band NGSO and MVDDS proponents – are allowed to cause, and permit tweeners to cause it instead, subject to a total ceiling of 10%. But the Commission is treaty-bound to observe the ITU limits developed for NGSO operators in the Ku-band, which is based on the 10% criterion. The Commission is thus not free to subject NGSO operators to a lower limit. As for NGSO licensees, they paid millions of dollars for the spectrum based on the unavailability increase that they are allowed to cause, and may be aggrieved by an after-the-fact change. In apparent recognition of these problems, the Commission has stated clearly in the *DBS NPRM* that "we are not revisiting the unavailability criteria previously adopted as they pertain to MVDDS and NGSO-FSS systems."[26]

There is another reason why the unavailability increase criterion (whether it be 10% or a lower amount) should not be adopted by the Commission. The criterion does not have anything like the wide international acceptance of the C/I and ΔT/T standards for assessing sharing between geostationary satellites. The only reason why the international community resorted to the unavailability increase method for NGSO-GSO sharing was the time variability of interference from NGSO satellites because of their orbits. This variability made it necessary to look to the total effects of NGSO operations over time. In the absence of such a special case, there is no reason for the Commission to abandon the C/I and ΔT/T methods and create an apples-and-oranges system for gauging GSO sharing.

In addition, while SES's and Spectrum Five's proposals are slightly different, both also suffer from a flaw similar to the flaw in the ITU coordination trigger – the higher the initial levels of unavailability, the higher the increase in unavailability that would be permitted. For example, if the initial level of unavailability is 0.1% (*i.e.* 99.9% availability), then a 10%

[26] *DBS NPRM* at ¶ 49.

increase in unavailability would be 0.01%, which would result in a total unavailability of 0.11%. However, for an initial unavailability of 0.2% (*i.e.* 99.8% availability), a 10% increase in unavailability would be 0.02%. Spectrum Five's proposal is particularly problematic because there is no absolute level of unavailability above which the impact on the existing DBS systems' quality of service would be considered unacceptable.[27] DBS subscribers will likely begin to switch MVPDs on quality grounds as levels of unavailability increase (even if overall availability remains fairly high), not least because cable companies have mounted an aggressive marketing campaign based on the alleged unreliability of satellite service.[28]

In brief, while the 10% unavailability increase criterion may be an appropriate one in situations where there is only one source of interference, (and that source is significantly time-varying), it is totally inappropriate where two other services have already been given entrée to the band under the same criterion, therefore reducing the availability of existing operators and allowing the third service to erode it further.

D. Existing DBS Operators Require a 24 dB C/I Ratio to Maintain Current Levels of Service and Meet Consumer and Regulatory Demands

As EchoStar and DIRECTV have urged, existing DBS services require a minimum C/I of 24 dB (with 45 cm dishes) in order to maintain existing levels of service and to

[27] Spectrum Five Comments at 4-7. SES's proposal at least recognizes the need to establish a minimum availability standard to protect current DBS operators. SES Comments at 17 ("The framework should permit deployment of a new system if it meets a set of tiered criteria that take into account . . . an absolute minimum availability.").

[28] Comcast and Charter have aggressively marketed against satellite competitors based on availability issues evidenced by the attached advertisements. Charter states that, "[u]nlike satellite, you won't miss a minute of your shows due to weather." Comcast similarly alleges that "acquiring satellite signal" is a "DISH DRAWBACK" justifying a switch to cable. *See* Exhibit 2.

meet consumer and regulatory demand for carriage of more bandwidth-intensive programming.[29] A 24 dB C/I is necessary for the use of advanced techniques (*e.g.*, 8PSK) to deliver High Definition ("HD") programming efficiently to subscribers using limited DBS spectrum. As consumer demand for HD programming intensifies, the ability to use advanced 8PSK modulation will be essential to the continued viability of DBS providers. 8PSK can multiply the capacity available to DBS providers by up to 1.5 times, but requires significantly higher C/I than standard QPSK modulation. In contrast, the 19 dB C/I criterion proposed by SES (which is not even a firm barrier under SES's proposal)[30] is simply too low to support the use of 8PSK as it would cause excessive degradation to the availability of transmissions employing that modulation.[31] Protecting existing DBS providers to no more than the 19 dB level could well force DBS operators to use QPSK for HD carriage, which in turn would seriously reduce the channel throughput of the available DBS spectrum.

A 24 dB C/I standard is also essential to ensure that DBS operators can continue to offer expanded and innovative new services, such as the new mobile DBS services recently introduced by EchoStar and DIRECTV.[32] Both providers have been offering some form of mobile DBS service for some time on board airplanes and in commercial trucks and recreational vehicles, but the latest offerings come in a small enough package to be installed in a car. By

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[29] To be clear, this is the C/I level that must be achieved after antenna pointing errors are taken into account.

[30] SES Comments at 18. Under SES's proposal, a 19 dB C/I would be no barrier if the 10% increase in unavailability criterion is met.

[31] *See* Technical Annex at A-23.

[32] See Press Release, Dish Network, DISH Network(TM) Introduces TV On The Go (Jan. 8, 2007), *available at* http://phx.corporate-ir.net/phoenix.zhtml?c=68854&p=irol-newsArticle&ID=948155&highlight=; Press Release, DIRECTV, DIRECTV Anywhere, Anytime, Anyplace (Jan. 8, 2007), *available at* http://phx.corporate-ir.net/phoenix.zhtml?c=127160&p=irol-newsArticle&ID=948169&highlight=.

necessity, mobile DBS devices use smaller antennas, which makes them particularly vulnerable to tweener interference. The introduction of tweeners without adequate protection would freeze development of such innovative services.

IV. "SYMMETRICAL" INTERFERENCE CRITERIA WOULD HAVE ASYMMETRICAL EFFECTS ON EXISTING DBS PROVIDERS AND CONSUMERS

It is neither necessary nor appropriate to impose "symmetrical" interference criteria on existing DBS operators to protect tweener DBS satellites. The optical appearance of "symmetry" would in this case amount to wildly asymmetrical burdens and discrimination against existing DBS operators and their subscribers. Existing providers have very limited flexibility to design their operations so as to accommodate sharing.

If heeded by the Commission, therefore, the call for "symmetry" would effectively force existing DBS providers (or their customers) to replace the millions of 45 cm (and possibly larger) dishes already in the market just to maintain current levels of service. Existing providers would also have to sacrifice power and channel capacity in order to protect tweener operations. In contrast, tweener entrants can immediately implement such measures to compensate for the power constraints necessary to protect the operations of existing DBS providers. Spectrum Five has admitted as much in its petitions for tweener satellites at 114.5° W.L.[33]

Moreover, it is simply not possible to satisfy the symmetrical interference criteria proposed by tweener proponents when real-world effects are adequately taken into account,

[33] *Spectrum Five, LLC*, DA 06-2439, Order and Authorization, File Nos. SAT-LOI-20050312-00062, SAT-LOI-20050312-00063, Call Signs S2667, S2668, at ¶ 29 (rel. Nov. 29, 2006) ("*Spectrum Five Order*").

especially when spot beams are involved, as explained by Dr. Barnett.[34] To impose symmetrical constraints on both incumbents and new entrants would likely render the incumbents and/or tweeners incapable of providing a meaningfully competitive MVPD service and, thus, deprive the public of a viable alternative to terrestrial MVPD providers.

The tens of millions of existing residential DBS subscribers are also the reason why ManSat's citation of precedent from the FSS is inappropriate. Specifically, ManSat attempts to support its call for existing DBS operators to share the burden of reduced orbital spacing (*e.g.*, by reducing operating flexibility, upgrading existing antennas, and/or deploying new equipment and satellites) by reference to the introduction of two-degree spacing in the FSS.[35] But unlike in the DBS service today, there were relatively few FSS customers when two-degree spacing was introduced. Moreover, virtually all of the FSS customers at the time were technically sophisticated earth station operators that could reasonably be expected to adapt to the reduced orbital spacing environment. In contrast, the DBS market today is characterized by millions of technically unsophisticated, residential subscribers. Neither the DBS providers nor their subscribers can reasonably be expected to adapt to such a catastrophic change in the operating environment.

An interference protection criterion that would effectively require existing DBS operators to radically reduce power or to swap out millions of dishes would also amount to an unconstitutional taking of EchoStar's investment in its satellite system and the property of

[34] *See* Technical Annex at A-17 to A-21.

[35] ManSat Comments at 9 (citing *Licensing of Space Stations in the Domestic Fixed-Satellite Service and Related Revisions of Part 25 of the Rules and Regulations*, 54 Rad. Reg. 2d 577 at ¶ 15 (1983)).

existing dish owners, without just compensation.[36] Specifically, a requirement that would force EchoStar to operate its satellites at reduced power (or not at all, if power cannot be reduced) is a taking of EchoStar's satellites.[37] In addition, a requirement that would render obsolete current customer equipment operating in conjunction with EchoStar's satellites would deprive dish owners of any "economically viable use" of their dishes.[38] Those customers who do not abandon EchoStar's service for that reason alone would have to purchase new equipment to receive equivalent service, and would likely be unable to sell their old dishes. Such deprivations satisfy all three parts of the *Penn Central* test for the regulatory taking of property in violation of the Fifth Amendment.[39]

Independent of the takings analysis, such a rule would also be impermissibly retroactive, as it would interfere with EchoStar's investment-backed expectations. In that respect, EchoStar notes that it has spent billions in obtaining licenses and building satellites to use its licensed spectrum without any reasonable notice that the Commission may adopt shorter

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[36] U.S. Const. amend. V. *See also Penn Central Transportation Co. v. New York City*, 438 U.S. 104 (1978). Such claims are not barred by the rule that there are no property rights in spectrum because personal property (not spectrum) would be taken. *See U.S. v. Sperry Corp.*, 493 U.S. 52, 62 n.9 (1989) (equating personal property to real property in the context of a takings claim); *Nixon v. U.S.*, 978 F.2d 1269, 1285 (D.C. Cir. 1992) (the same).

[37] EchoStar's satellites were designed and intended to operate at certain power levels, and each dBW of power and each dB of link margin that the Commission takes away through technical constraints would reduce the economic value of those satellites.

[38] *See Lucas v. South Carolina Coastal Council*, 505 U.S. 1003, 1016 (1992).

[39] *Penn Central*, 438 U.S. at 124. The three part test is satisfied as follows. First, the proposed symmetrical constraints are not reasonably designed to attain the Commission's goal of increasing competition in the MVPD market – other means with fewer drawbacks are available to the Commission. Second, both EchoStar and consumers would sustain significant economic harm because of the need to replace existing dishes to maintain service. EchoStar would also suffer harm from the loss of customers that would likely result from the need to use larger dishes or the resulting lower quality of service. And third, symmetrical constraints would defeat the investment-backed expectations of EchoStar that its system, as designed, would be capable of meeting the demands of its customers into the reasonable future, as well as the expectations of consumers when they bought their dish that they would be able to receive EchoStar service.

orbital spacing for the DBS service in the future.[40] Imposing symmetrical technical constraints that would "make[] worthless substantial past investment incurred in reliance upon the prior rule" would constitute "unreasonable secondary retroactivity" that would be invalid under the Administrative Procedure Act ("APA").[41]

For all of these reasons, asymmetrical interference protection criteria are not only appropriate but unavoidable. Both EchoStar and DIRECTV have proposed a 12 dB C/I level of protection for tweeners from existing DBS providers as a likely level that could be achieved during coordination, provided significant changes are made to the characteristics of the proposed tweener satellite networks.[42]

V. OTHER LICENSING ISSUES

EchoStar reiterates that any licensing system adopted by the Commission should include strict financial qualification requirements, along the same lines as the financial

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[40] Notably, the Commission's December 1995 DBS order, which initiated DBS auctions, warned potential DBS applicants of the possibility that the *Advanced Order* might be reversed on appeal and result in the rescission of the DBS licenses on auction. In stark contrast, the order made no mention of the possibility of reduced orbital spacing. *See Revision of Rules and Policies for the Direct Broadcast Satellite* Service, 11 FCC Rcd 9712, at ¶ 152 (1995). The earliest mention of smaller orbital spacing as a remote possibility is found in the Commission's Notice of Proposed of Rulemaking released on February 26, 1998. *See Policies and Rules for the Direct Broadcast Satellite Service*, Notice of Proposed Rulemaking, 13 FCC Rcd 6907, at ¶ 50 (1998). By then, however, EchoStar had already spent hundreds of millions of dollars to launch three DBS satellites and to construct a fourth. No further mention was made of reduced spacing until 2002, by which time EchoStar had launched a total of seven DBS satellites, with an eighth under construction. *See Policies and Rules for the Direct Broadcast Satellite Service*, Report and Order, 17 FCC Rcd 11331, at ¶ 129 (2002).

[41] *See Bowen v. Georgetown University Hospital*, 488 U.S. 204, 220 (1988) (Scalia, J., concurring) ("A rule that has unreasonable secondary retroactivity – for example, altering future regulation in a manner that makes worthless substantial past investment incurred in reliance upon the prior rule – may for that reason be 'arbitrary' or 'capricious,' *see* 5 U.S.C. § 706, and thus invalid.").

[42] EchoStar Comments at 11; *id.*, Exhibit 1 at A-14; *DBS NPRM* at ¶ 44, *citing* Petition of DIRECTV Enterprises, LLC, for a Rulemaking on the Feasibility of Reduced Orbital Spacing in the U.S. Direct Broadcast Satellite Service (filed Sept. 5, 2003).

qualification rules applicable to FSS licensees prior to 2003.[43] DBS applicants must be able to demonstrate, through their balance sheet or through evidence of debt or equity financing arrangements, that they have the financial resources to construct and launch the licensed satellite, and to operate it for one year. Certainly, the Commission should not be granting any DBS application without such a showing and without imposing a performance bond to secure timely construction. None of the commenters argue that such requirements are unnecessary.

Likewise, none of the tweener proponents suggest imposing a full-CONUS spectrum cap or similar eligibility restriction on DBS licensees. Indeed, Spectrum Five specifically opposes any such restriction.[44] As EchoStar has explained, such restrictions are unnecessary under current market conditions and none should be adopted here.[45] Similarly, restrictions on the entities eligible to hold a permanent license for the two unassigned DBS channels at 61.5° W.L. should also be lifted.[46] The special eligibility restrictions on those two unassigned channels were imposed due to "unique circumstances" and the Commission's hope that Rainbow DBS Company, LLC ("Rainbow") – a company that already held a license for 11 DBS channels at that location – would emerge as a more vibrant competitor if EchoStar and

[43] *See* 47 C.F.R. § 25.140(c)-(d) (2002), *eliminated by Amendment of the Commission's Space Station Licensing Rules and Policies; Mitigation of Orbital Debris*, First Report and Order and Further Notice of proposed Rulemaking, 18 FCC Rcd 10760, ¶¶ 161-165 (2003) ("*First Space Station Licensing Reform Order*").

[44] Spectrum Five Comments at 9.

[45] EchoStar Comments at 15-17.

[46] *Auction of Direct Broadcast Satellite Licenses*, Order, 19 FCC Rcd 23849 (2004).

DIRECTV were kept out of an auction for those licenses.[47] Now that circumstances have changed, there is no basis for maintaining this restriction on the two channels at 61.5° W.L.[48]

VI. CONCLUSION

The detailed factual record in this proceeding demonstrates the complexity of issues at stake, and the lack of consensus on how to proceed even amongst tweener proponents. Thus, it appears that the safest course of action is for the Commission to first explore the other identified spectrum options to increase DBS capacity.

Respectfully submitted,

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January 25, 2007

[47] *Id.* at ¶¶ 15-24.

[48] Rainbow exited the DBS business shortly after it launched its first satellite by selling the satellite and transferring its license to EchoStar. *See Rainbow DBS Co., LLC, and EchoStar Satellite L.L.C.*, 20 FCC Rcd 16868 (2005). Rainbow has agreed that "'[t]here is simply no basis for maintaining such [eligibility] restrictions in light of these changed facts'" and does not oppose EchoStar's petition for reconsideration of those restrictions. EchoStar Petition for Reconsideration at 2, *filed in* Auction for Direct Broadcast Satellite Service Licenses, File No. AUC-03-52 (filed May 20, 2005); *see also id*. at 2 n.4 ("Cablevision and Rainbow DBS have informed EchoStar that they do not oppose the elimination of these eligibility restrictions and EchoStar's petition for reconsideration in this proceeding.").

EXHIBIT 1

TECHNICAL ANNEX

TECHNICAL ANNEX

A.1 INTRODUCTION

This annex addresses the technical and associated ITU regulatory issues resulting from the Comments received in response to the Commission's Notice of Proposed Rulemaking ("NPRM") concerning the feasibility of reduced orbital spacing for Direct Broadcast Satellite service in the U.S.[1] It also provides important new factual data concerning the pointing errors of typical DBS subscriber dishes, and addresses interference criteria proposed by Spectrum Five and SES Americom.

A.2 RECEIVE DISH POINTING ERROR

The receive dish pointing error is a critical factor in the determination of adjacent satellite interference, and is proving to be particularly important when considering close spaced DBS satellites in the 12 GHz band. Until recently very little factual data was available to quantify this pointing error effect, but this situation has now changed significantly. DIRECTV, in its Comments in this proceeding, has presented directly relevant measured data that confirms considerably higher dish pointing errors than the tweener proponents have considered to date.[2] This is discussed in more detail in Section A.2.1 below. Independently, EchoStar has recently implemented a way to collect data from real subscriber installations that can be related directly

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1 *Amendment of the Commission's Policies and Rules for Processing Applications in the Direct Broadcast Satellite Service; Feasibility of Reduced Orbital Spacing for Provision of Direct Broadcast Satellite Service in the United States*, FCC 06-120, Notice of Proposed Rulemaking, 21 FCC Rcd 9443 (2006) ("*DBS NPRM*"). The *DBS NPRM* was published in the Federal Register on September 28, 2006. *See* 71 Fed. Reg. 56,923 (2006).

2 *See* Appendix A to DIRECTV Comments to the NPRM, 12 December 2006.

back to dish pointing errors. The first, and very recent data, collected by EchoStar in this way are presented and discussed in Section A.2.2 below.

A.2.1 DIRECTV's Dish Pointing Error Results

DIRECTV's measured data on dish pointing error, as given in its Comments to the NPRM, are based on empirical measurements made at random subscriber sites using a physical laser-enhanced measurement technique.[3] The results are conclusive and show that considerable mispointing of the receive dishes exists at a significant percentage of subscriber installations. DIRECTV's results show that pointing errors of at least 1° exist at typically 50% of installations, while pointing errors of 2° or even greater exist at typically 10% of installations. The publication of this data was the first time such relatively high pointing errors have been known for a fact. This data must be taken into account by the Commission in this proceeding as it dramatically affects the viability of tweeners.

A.2.2 EchoStar's Dish Pointing Error Data

EchoStar has recently implemented a "receiver health and status" program where signal strength and other data from certain subscriber installations is monitored remotely. These data are collected in the subscriber receiver (in-door unit) and transmitted back via telephone data connection to EchoStar's network control center where it provides useful information concerning the equipment status and service quality at the subscriber locations. Data from many thousands of subscriber installations have been collected in this way across all of CONUS. The signal strength data (which are actually measured as a signal-to-noise ratio) can be used to effectively measure signal strength differences between different installations in the same geographic area that are receiving essentially the same EIRP level from the same satellite. These signal strength

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[3] *See* Appendix A to DIRECTV Comments to the NPRM, 12 December 2006.

differences can be accounted for primarily as a result of dish pointing errors which result in signal loss, as explained below.

Other possible causes of loss of signal strength (or corresponding reductions in signal-to-noise ratio) at subscriber installations have been considered, and discounted, as follows:

- Each set of data exhibiting the signal strength variations was taken from subscriber locations that are within the same city area and on the same satellite transponder on the same satellite. Therefore, within the set, all locations are effectively receiving the same EIRP level on the channel being measured.

- Variations in the noise figure of the receiver installation, which is dominated by the noise figure of the LNB (Low Noise Block-downconverter). Typical variation in the LNB noise figure, from unit to unit and over the operating temperature range, is typically less than 0.4 dB, which is negligible compared to the signal strength differences that are being measured.

- Variation in the peak gain of the subscriber dishes. This effect can be discounted because the measured data was collected from installations where the dishes had very similar antenna gain, within a few tenths of a dB of each other.

- Obstructions in the line-of-sight from the receive dish to the satellite, such as would be caused by foliage or even a building. Foliage blockage is a very minor factor in the winter months and the data reported here were measured in late December 2006 and early January 2007. Therefore, it is not possible for the signal strength reduction effects observed in this data to be caused by foliage attenuation. Building blockage, if it was occurring, would typically be many tens of dB, and such blockage effects, producing signal attenuation levels of this magnitude, would result in no service availability at the installation, and therefore cannot be the cause of the measured signal strength reductions.

- Variations in the signal strength due to rain attenuation. The data collected so far were measured in the early hours of the morning, local time, and this is typically a time of the

day not subject to heavy rainfall in most parts of the U.S. Furthermore, the data collected in several of the locations were not subject to any significant rainfall during the general period that the measurements took place, yet the results for all locations are similar.[4]

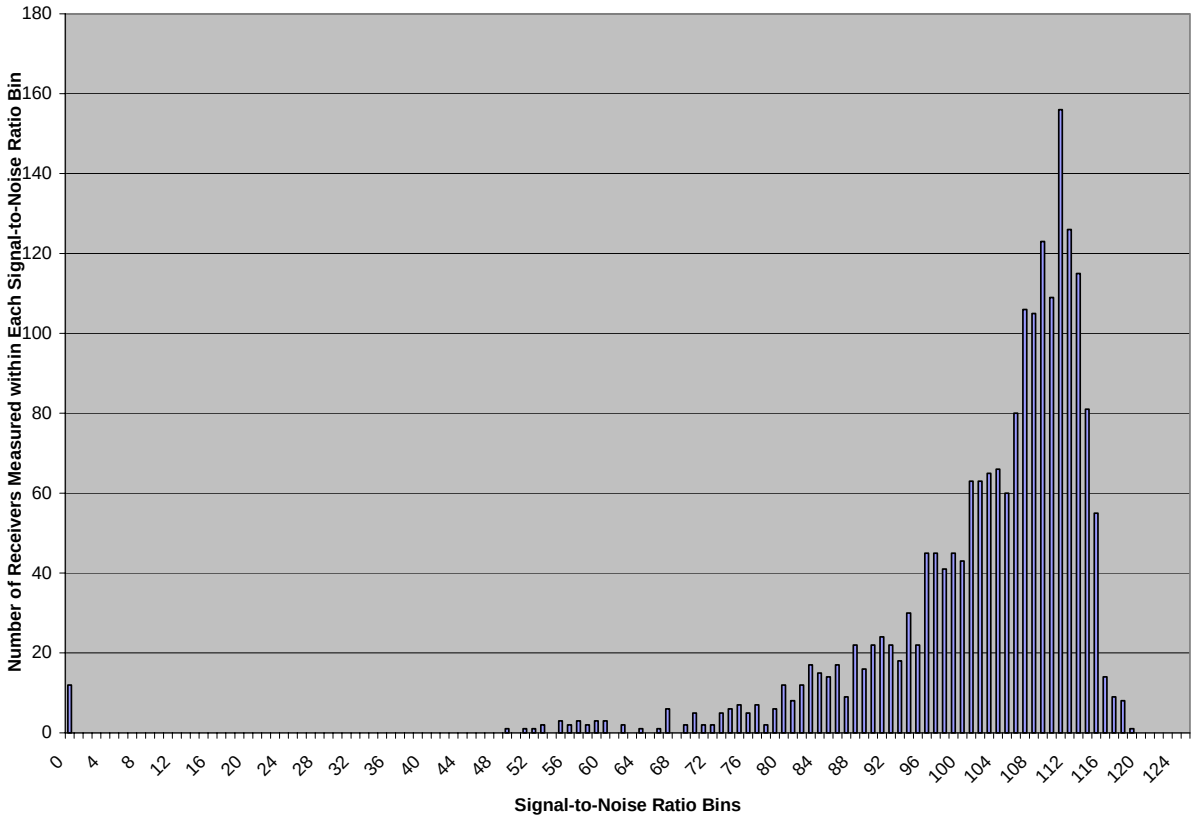
- In any event, EchoStar has appropriately accounted for the above factors, as explained further below.

Therefore EchoStar is confident that the variation in signal strength being measured between near collocated subscriber sites is caused predominantly by the differences in pointing of the subscriber dishes.

Figure 1 below shows a typical set of data collected in this way, in this case from Dallas, TX. This is in the form of a histogram giving the number of subscriber receivers (shown on the vertical axis) where the signal meter reading is in a range of one point on the signal meter (signal meter levels are shown on the horizontal axis). For example, the highest vertical bar in Figure 1 below corresponds to 156 locations exhibiting a signal-to-noise meter reading within the bin range 112 to 113. Note the significant number of locations with quite widely varying meter readings, which is indicative of significant dish pointing error.

[4] Nevertheless, EchoStar is in the process of repetitively collecting more data from the same sites, allowing it to discard any short-term signal strength reductions that might be caused by rain attenuation to further improve the confidence that the measured signal strengths are not significantly affected by rain attenuation.

Figure 1 - Histogram showing Signal Meter Data for Dallas, TX

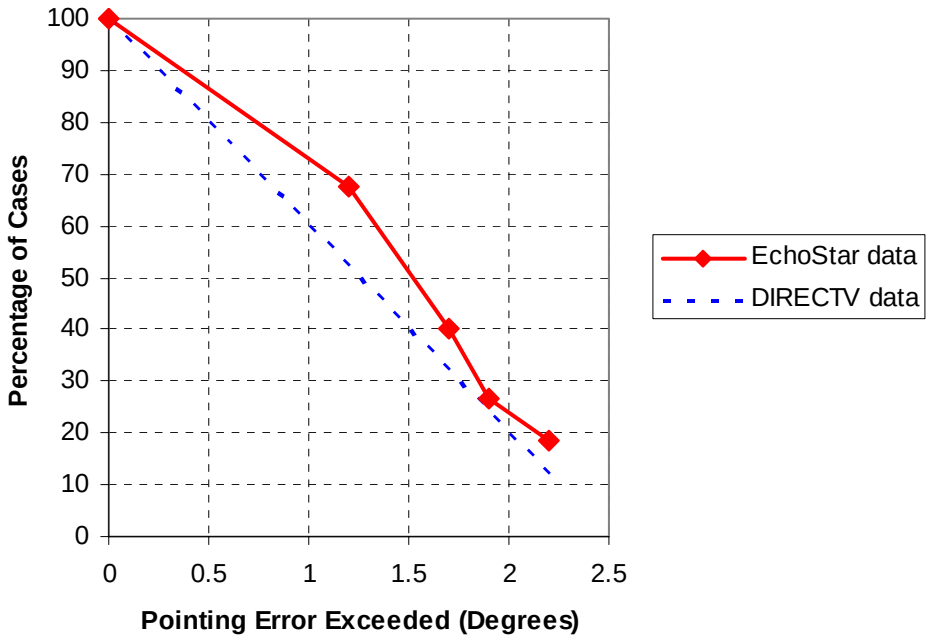


The data of the type shown in Figure 1 is then processed as follows in order to quantify the statistical dish pointing error. Firstly, the signal strength corresponding to zero mispointing is conservatively assumed to be four points below the highest level observed for that general geographic location on the signal meter readings. This allows for approximately 0.7 dB of signal level variation that might be due to other effects, such as LNB noise figure variation, dish gain variation, etc. Therefore, in the case of Figure 1, the highest signal meter reading is 120 (on the horizontal axis), so the assumed signal strength reference for zero mispointing is assumed to be 120 – 4 = 116. Then, using this derived reference for zero mispointing, the histogram data, such as that in Figure 1 above, is converted to a cumulative distribution that gives the number of locations where the signal meter reading is more than a certain number below the zero mispointing reference. The signal meter reading is then converted to a dB signal level reduction using the known sensitivity of the receiver S/N meter (6 signal meter reading points are approximately equal to 1 dB), and then further converted to an off-axis pointing error necessary

to cause such a signal level reduction, using the known off-axis gain characteristic of the receiving antennas for which the measurements were obtained.

Using the above methodology the statistical dish pointing error results shown by the solid red line in Figure 2 below were derived, for the Dallas, TX data. This is in the form of a cumulative distribution giving the percentage of installations for which the dish pointing error exceeds a certain value. These results show, for example, that more than 70% of the installations exceed a pointing error of 1°.

Figure 2 - Cumulative Distribution of Dish Pointing Error for Dallas, TX



Note that the results in Figure 2 above are in the same format as DIRECTV's results, and the dotted blue line that has been included in Figure 2 is the DIRECTV "curve-fit" data as presented in DIRECTV's Comments.[5] These results show surprisingly close agreement between the

[5] DIRECTV's curve-fit date is given in Figure 6-1 of Appendix A of DIRECTV Comments to the NPRM.

EchoStar and DIRECTV mispointing data. That two such completely independent measurement programs, each taking a completely different approach to the measurement of typical dish pointing error, produce such similar results, is evidence that these dish pointing effects are real and consistent, as measured. They represent the actual situation that exists at the homes of tens of millions of Americans, and show a particularly dangerous vulnerability to interference from tweener satellites. These results of both EchoStar and DIRECTV must therefore be taken into account by the Commission in its deliberations on the possibilities for close-spaced DBS satellites in the 12 GHz band. As will be seen in later sections of this document, they significantly impact the conclusions concerning the viability of tweeners.

These measured data demonstrate the error of assuming that DBS dish pointing errors generally do not exceed 0.5°. In particular, it is wrong to extrapolate from the typical pointing errors that occur in the FSS (Fixed Satellite Service). DBS dish installations are very different in many respects from a typical FSS antenna installation. Economic imperatives dictate that the DBS installations are relatively low-cost, both in terms of the equipment (such as antenna mounts and how they can be adjusted) as well as in the level of training of the installation technician and the time spent performing the installation. Therefore this latest dish mispointing data from both EchoStar and DIRECTV is not, in some respects, very surprising, in light of the realities of the DBS industry. This latest data should be used by the Commission in its further assessment of the impact of the proposed tweeners.

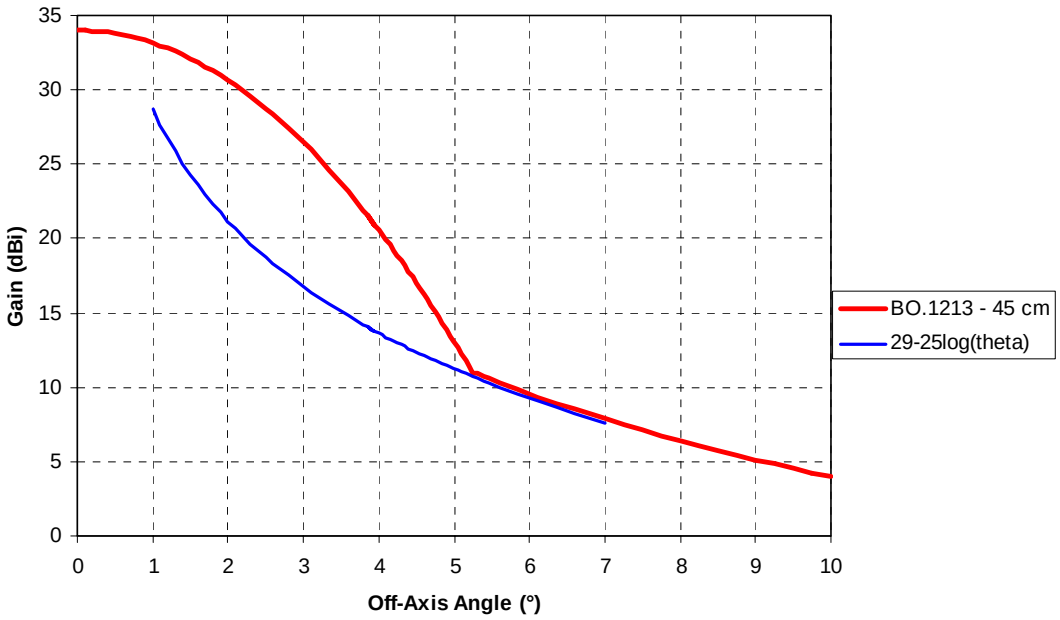
A.2.3 The Off-Axis Gain Mask in §25.209(a)(1) is Not Appropriate for Interference Assessment Related to Tweeners

Figure 3 below shows the ITU-R Recommendation BO.1213 off-axis gain mask for a 45 cm antenna that is normally considered for assessing interference between 12 GHz DBS satellites.[6]

[6] ITU-R Recommendation BO.1213 was the result of exhaustive studies in ITU Working Party 6S (and its predecessor Working Party 10-11S) using significant amounts of measured data from different administrations around the world. A detailed report was prepared and used as the basis for this Recommendation.

Also shown in this diagram is the familiar mask from §25.209(a)(1) (the "29-25log(θ)" mask). Note that the BO.1213 mask has significantly higher off-axis gain for angles less than 5 degrees, which includes the direction of the proposed tweener satellites. Note also that, when significant dish pointing error is taken into account, as indicated in Sections A.2.1 and A.2.2 above, the effective off-axis angle in the direction of the interfering tweener satellite reduces to a value as low as 2 to 3 degrees, where the difference between the two masks shown in Figure 3 is as high as 10 dB. Therefore the §25.209(a)(1) mask, which was used throughout Spectrum Five's interference analysis, is completely inappropriate for use in assessing tweener related interference, and Spectrum Five's recommendation that it be adopted as a standard for this purpose should be rejected.[7]

Figure 3 - Comparison of BO.1213 and §25.209(a)(1) Off-Axis Gain Masks



[7] See Comments of Spectrum Five, Section IV, page 8. See also Comments of Spectrum Five, Technical Exhibit, Table 2, page 5 and same document, page 8, page 10.

A.2.4 Dish Pointing Error Does Not Cancel Out

The actual measured dish pointing reported in Sections A.2.1 and A.2.2 above is in stark contrast to the tweener proponents' view of the significance of dish pointing effects as discussed below. There are two issues to note here: Firstly, the tweener proponents are vastly under-estimating the dish pointing errors, and secondly, they are asserting that the errors actually cancel out producing negligible increase in interference relative to the case of no pointing error.

Spectrum Five states in its Comments to the NPRM that "… *Spectrum Five believes subscriber pointing error effects are almost negligible. If two adjacent satellites are considered, with a given subscriber antenna pointing error, the interference from one adjacent satellite increases while the interference from the other adjacent satellite decreases, the overall result will be a slight decrease in the C/I (approximately 0.3 dB) assuming all satellites have the same PFD.*" [8]

SES Americom similarly makes light of the subscriber dish mispointing effects, stating in its Comments to the NPRM that "*SES Americom recognizes that mispointing, typically within the range of 0.5 degrees, is not uncommon with respect to existing DBS user terminals ….*" SES Americom goes on to state "*… if an antenna is mispointed toward an adjacent satellite to the east, it will receive relatively more interference from that adjacent satellite than it would if it were pointed accurately. However, that antenna will also receive relatively less interference from the satellite to the west than it would if it were pointed accurately. This mispointing will have no significant net effect on the total strength of the interfering signals received at the antenna. As a result, user terminal pointing accuracy should not be used as a factor in analysis of proposals for new DBS spacecraft at reduced orbital spacing.*"[9]

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8 *See* Comments of Spectrum Five, Technical Annex, page 10.

9 *See* Comments of SES-Americom, Section III.C, page 15, also similar comments in the Technical Appendix, Section 3.3, page 4.

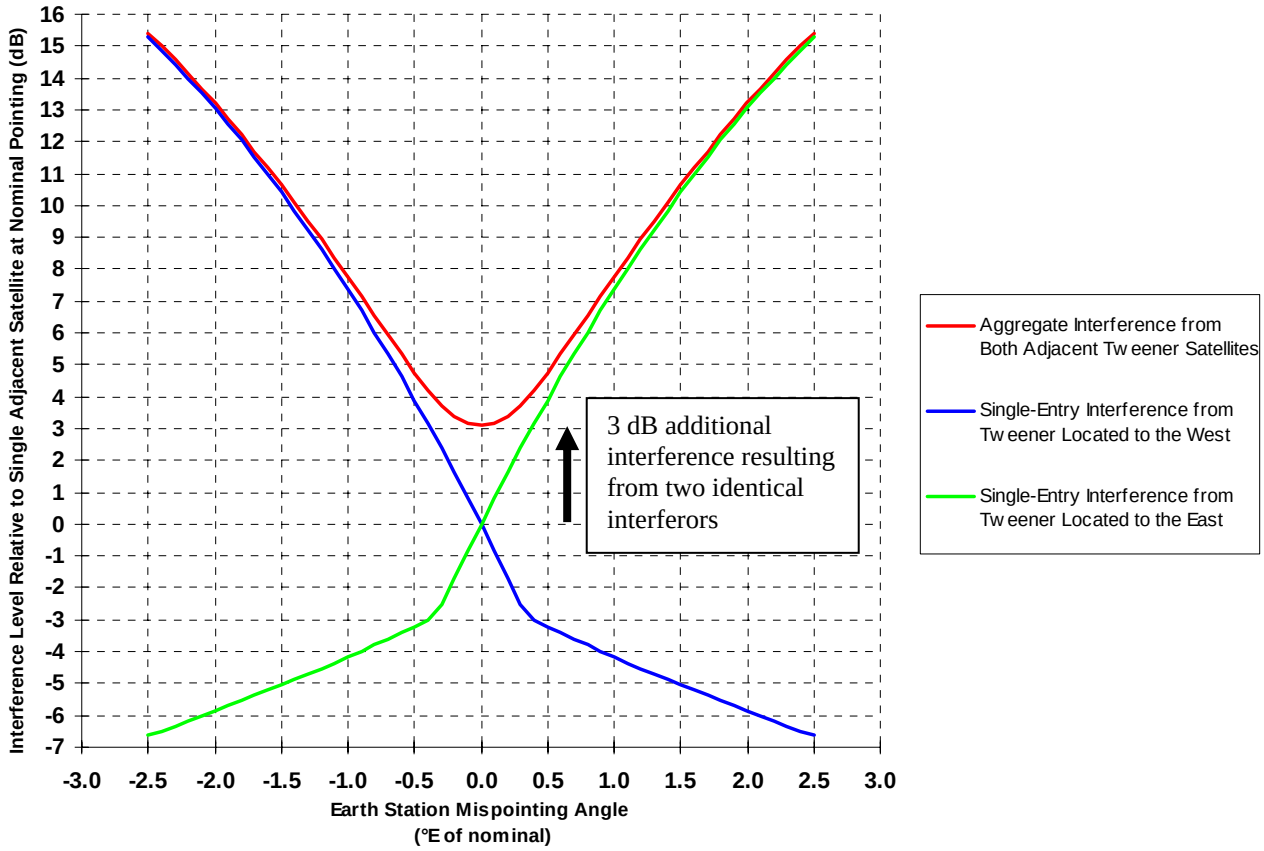
EchoStar disagrees completely with the above statements and recommendations of Spectrum Five and SES Americom. Their assertions are incorrect in terms of their estimate of the magnitude of the pointing error, and technically flawed as regards the assertion that the pointing error effects cancel out, as explained further below. Therefore, they must be completely discounted by the Commission.

Figure 4 below shows the analysis of the aggregate interference from two (assumed identical) adjacent tweener satellites, as the mispointing of the receive dish is varied along the geostationary arc. The analysis assumes the following:

- 45 cm receive antenna meeting ITU-R BO.1213 off-axis gain mask at 12.2 GHz;
- Wanted satellite located at 110°W, with interfering tweener satellites located at 105.5°W and 114.5°W. This results in the (topocentric) off-axis angle between the wanted satellite and each interfering satellite being approximately 4.9°.

Note that the analysis correctly takes account of the fact, as both Spectrum Five and SES Americom point out, that the interference from one satellite increases while the interference from the other satellite decreases, as the receive antenna is mispointed. This is shown by the blue and green data lines in Figure 4 which show the individual single-entry interference levels from each adjacent tweener satellite. However, because of the non-linear nature of the BO.1213 mask, the reduction in interference from one satellite is not equal to the increase in interference from the other satellite. The net effect is therefore not a constant interference level, as both Spectrum Five and SES state, but rather a steeply rising increase in the overall aggregate interference level, as shown by the red data line in Figure 4. This is not a surprising result given the BO.1213 off-axis gain mask characteristic.

Figure 4 - Aggregate Interference from Two Adjacent Tweener Satellites vs. Mispointing of the Receive Antenna



Note that, for nominal earth station pointing (zero mispointing on the horizontal axis in Figure 4), the interference is 3 dB worse than for a single-entry interferor, yet this is the best-case interference scenario as a function of mispointing angle. As the mispointing angle increases, in either direction, the aggregate interference increases quite dramatically, with approximately 1.7 dB additional interference for 0.5° mispointing, 4.6 dB additional interference for 1° mispointing, 7.5 dB additional interference for 1.5° mispointing, and 10.1 dB additional interference for 2° mispointing.

The above clearly demonstrates that earth station mispointing, of a magnitude consistent with the empirical data presented in Section A.2.2 above, will dramatically increase the interference from tweener satellites, and must be taken account of in any tweener interference analysis.

A.2.5 Conclusions Regarding Dish Pointing Error

In Sections A.2.1 and A.2.2 above we discuss the significant pointing error that occurs in DBS receiver installations based on data obtained completely independently by DIRECTV and EchoStar. This shows that pointing errors in the range of 1 to 2 degrees exist for a very large number of the installed 30 million or so DBS dishes.

In section A.2.4 above we demonstrate that dish pointing errors of these magnitudes result in very significant increases in interference from tweener satellites, relative to the "no pointing error" analysis that Spectrum Five and SES have performed, and conclude therefore that dish pointing errors must be factored into any interference assessment of tweeners.

The fact that dish pointing errors are so significant in a tweener environment is not surprising, as illustrated in Figure 5 below. This diagram shows the BO.1213 off-axis gain mask (for a 45 cm antenna) with various angular offsets, which represent dish mispointing in 0.5° increments. The general direction of tweener satellites spaced nominally 4.3° away is shown by the left hand vertical gray bar, which encompasses a range of off-axis angles that would typically exist from different parts of CONUS.[10,11] Note the rapid increase in the off-axis gain towards the tweener satellite as the dish pointing error is increased, with increases typically of 7 to 8 dB for 1° mispointing and approximately 13 dB for 2° mispointing, relative to the single-entry interference case with no mispointing. Such increases in off-axis gain result directly in increased tweener interference levels. Note that, even with 1° mispointing, the receive dish barely manages to give more than 11 dB of discrimination towards the tweener satellite (i.e., 34 dB peak gain and 23 dB off-axis gain), which can be related directly to a C/I level of 11 dB assuming both wanted and

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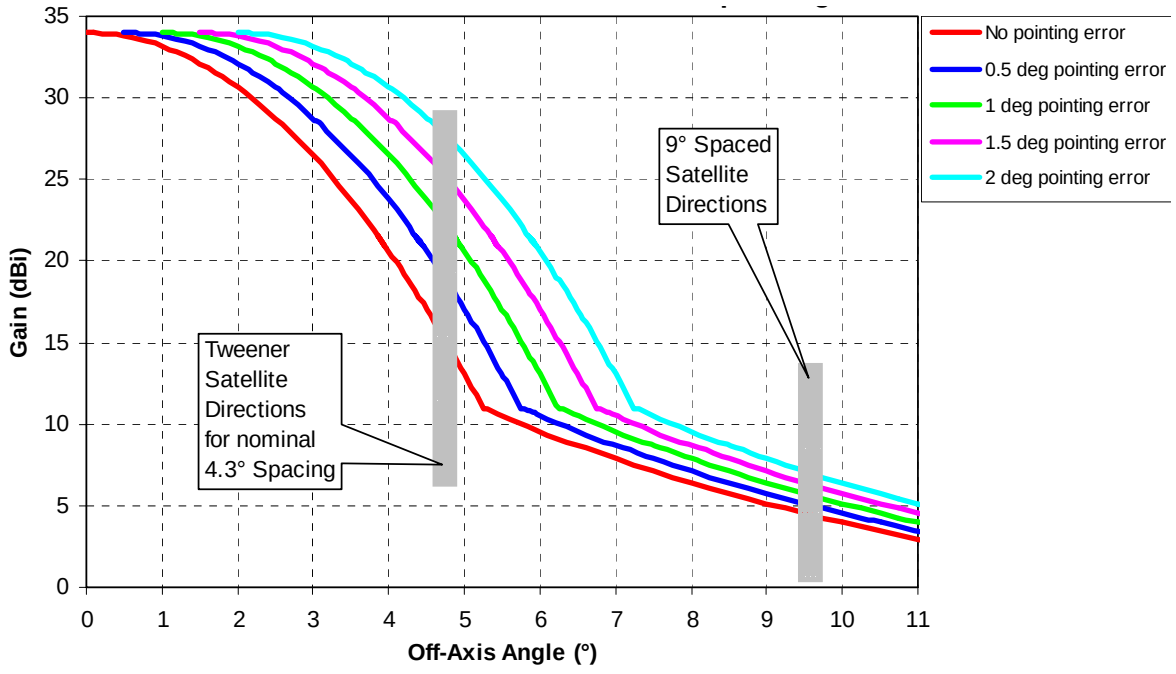
[10] 4.3° nominal spacing would be appropriate, for example, in the case of an existing DBS satellite at 109.8°W and a tweener satellite at 105.5°W.

[11] The range of off-axis angles are the topocentric angles measured from the Earth's surface, which are somewhat greater than the "geocentric" angles given by the nominal orbital separation of 4.3° in this example. These topocentric angles a function of the elevation angles to the satellite, which in turn depends on the geographic location on the Earth's surface.

interfering satellites radiate the same downlink EIRP. With 1.5° mispointing this C/I would reduce to less than 9 dB, and with 2° mispointing to only 6 dB C/I.

Figure 5 also shows why such dish pointing errors are unnoticeable in a 9° spacing environment, as currently exists with U.S. DBS satellites. This is shown by the right hand vertical gray bar which corresponds to the range of topocentric angles that exist from different parts of CONUS for 9° nominal satellite spacing. Note the very small increases in off-axis gain as a result of dish mispointing for this situation, with less than 3 dB increase in gain for 2° pointing error. Note also the high levels of off-axis discrimination that exists in this 9° spacing situation, in excess of 26 dB (i.e., 34 dB peak gain and <8 dB off-axis gain) even with 2° mispointing, which equates to C/I levels in excess of 26 dB assuming both wanted and interfering satellites radiate the same downlink EIRP.

Figure 5 - Effects of Dish Pointing Error on Adjacent Satellite Interference Levels



It should also be noted that Spectrum Five is proposing orbital assignment arrangements that result in the nominal separation as low as 4.1°, which is 0.2° worse than that considered in

Figure 5 above.[12] In this case the 11 dB receive dish discrimination referred to above (for 1° mispointing) reduces to approximately 8 dB C/I, the C/I for 1.5° mispointing reduces to around 6 dB and the C/I for 2° mispointing reduces to around 4 dB.

A.3 MULTI-FEED DISH POINTING ERRORS

In its Comments to the NPRM EchoStar explained the relatively poor off-axis gain performance of multi-feed dish antennas.[13] There is an additional factor to do with such multi-feed dish antennas which contributes towards the dish mispointing.

Multi-feed dishes are constructed with a fixed (i.e., not adjustable) angular spacing between the two (or three) feeds.[14] This angular spacing would ideally correspond to exactly the angular spacing, at the dish antenna, between the two (or three) satellites that are to be received by the dish antenna. However, the angular separation between the satellites as seen from the dish antenna on the surface of the Earth (the "topocentric" angle) is somewhat larger, by approximately 10%, than the "geocentric" angular separation between the satellites. Such difference between the geocentric and topocentric angular separation is not itself a problem, but the problem is that the topocentric separation angle is not a constant for a given geocentric separation. It depends on the location of the dish antenna on the surface of the Earth. At low elevation angles, such as would occur in New England or north-west CONUS, the distance to the satellite is slightly larger than average and so the topocentric separation angle is smaller. Conversely, in the southern parts of CONUS, and particularly at longitudes close to the satellite longitude, the topocentric angular separation is larger than average, because the distance to the satellite a slightly less. Typically, the multi-feed dish antenna would be constructed with feeds separation angles corresponding to the average topocentric angular separation between the

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12 *See* Comments of Spectrum Five, Technical Exhibit.

13 *See* Comments of EchoStar, Technical Annex, Section A.4.

14 *See* Comments of EchoStar, Technical Annex, Figure A.4-1.

satellites. When this antenna is then installed away from the "average" location in CONUS, such as in the north-east or north-west, or in the south of CONUS, there is an intrinsic pointing error for one or all of the feeds.

Consider the example of a triple-feed antenna designed to receive signals from 110°W, 119°W and 129°W. Such an antenna is already in widespread use in the EchoStar DBS system. For the two feeds on this antenna pointing towards the 119°W and 129°W satellites, the minimum required angular separation (topocentric angle) occurs in the north-east of CONUS, with a Boston value of 10.56°. The maximum required angular separation occurs in the south-west of CONUS, with a San Diego value of 11.39°. The difference between these two extremes is 0.83°. Therefore the actual fixed angular separation between the feeds of such an antenna would be mid-way between these two, with an angle of 10.97°. When such an antenna is installed it must be pointed such that the center feed (for the 119°W satellite) is pointed as accurately as possible, so as to minimize the simultaneous pointing errors of the 110°W and 129°W feeds. In that case, the feed pointing towards the 129°W satellite would be 10.97° away from the 119°W satellite, which would give a pointing error of 0.41° towards the 129°W satellite when the antenna was installed in Boston (i.e., 10.97 – 10.56), and a pointing error of 0.42°, in the opposite direction, when the antenna was installed in San Diego (i.e., 10.97 – 11.39).

These pointing errors due to topocentric angle variation across CONUS are independent of, and therefore will add to, any random statistical pointing errors resulting from the installation of the dish antennas. Furthermore, they are inevitable pointing errors, regardless of how accurately the dish is pointed during installation. The magnitude of these additional pointing errors (~0.4°) is comparable to the total pointing error suggested by SES to date, which is only 0.5°.[15] Clearly, with such inherent pointing errors, a reasonable overall allowance for pointing error with any new dish installations of this type, must be significantly greater than ~0.5°.

A.4 TWEENERS WITH SYMMETRICAL INTERFERENCE CRITERIA ARE NOT POSSIBLE

In this section we will address the proposal made by both Spectrum Five and SES Americom that the interference criteria between established DBS satellite operators and the operators of the new tweener satellites be symmetrical, i.e., that the same criteria should be used in both directions of interference (established DBS-into-tweeners and tweeners-into-established DBS).[16,17] We will show that such a proposal is simply impossible to realize even assuming the 10% increase in unavailability criterion suggested by Spectrum Five and SES Americom.

Firstly, we will consider the case of the CONUS beam on an established DBS satellite, such as EchoStar-8. This has a peak EIRP (in Florida) of approximately 57.5 dBW. The minimum EIRP, which is generally applicable over the western half of the USA, is approximately 52 dBW. Now consider a Spectrum Five tweener satellite which, according to the Spectrum Five FCC application, produces peak EIRP levels between 56.7 dBW and 63.5 dBW for 8PSK operation, depending on the spot beam.[18] It is not clear from the Spectrum Five application what minimum downlink EIRP is required, but we will assume it corresponds to the -4 dB gain contour of the spot beams, which results in minimum EIRP levels for QPSK operation of between 49.8 dBW and 56.7 dBW.[19] Therefore it appears quite likely that many locations will occur across CONUS where the following, or similar, conditions exist:

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[15] It should be noted that Spectrum Five has not clearly stated what pointing error should be considered. Also, both Spectrum Five and SES Americom have proposed to ignore dish pointing error in any assessment of tweener interference.

[16] *See* Comments of Spectrum Five, Section III and Technical Exhibit.

[17] *See* Comments of SES Americom, Section III.F.

[18] *See* Spectrum Five FCC Application, Technical Appendix, Table 8.

[19] *See* Spectrum Five FCC Application, Technical Appendix, Table 6.

a) Spectrum Five radiates in excess of 63 dBW where EchoStar might be radiating typically 55 dBW. This is an 8 dB EIRP differential in favor of Spectrum Five. Note that 55 dBW is already 3 dB above the minimum EIRP level for EchoStar-8 CONUS beam, and so is quite likely to correspond to locations that are subject to the peak Spectrum Five EIRP levels.

b) EchoStar-8 radiates in excess of 56 dBW where Spectrum Five might be radiating typically 53 dBW. This is a 3 dB EIRP differential in favor of EchoStar. Note 53 dBW is a mid-range value (across its different spot beams) for Spectrum Five minimum EIRP and therefore is quite likely to correspond to locations that are subject to the EchoStar-8 EIRP level of >56 dBW.

Next we will assess the typical C/I levels from these two situations described above. Firstly, in terms of the interference from Spectrum Five into EchoStar (case (a) above), and conservatively assuming only 1° mispointing of the EchoStar receive dish, the dish discrimination would be 11 dB (see Figure 5 above), and the resulting C/I would be 3 dB (i.e., 11 – 8 dB EIRP differential). Clearly the EchoStar network would not be viable with such low C/I values. In the other direction (case (b) above), we will assume that Spectrum Five can achieve the 0.5° pointing error that it suggests is feasible, in which case a 45 cm BO.1213 Spectrum Five dish would achieve an off-axis discrimination of approximately 15 dB (see Figure 5 above), resulting in a C/I of 12 dB (i.e., 15 – 3 dB EIRP differential).

The next step is therefore to consider appropriate reductions in the Spectrum Five downlink EIRP levels to adequately protect the EchoStar satellite, as might take place during the coordination exercise that Spectrum Five foresees. Spectrum Five indicates that C/I levels into EchoStar in the region of 24 dB would be required to achieve the Spectrum Five proposed interference criterion of 10% increase in unavailability for the EchoStar links.[20,21] To achieve

[20] *See* Comments of Spectrum Five, Technical Exhibit, Table 3.

such C/I levels in the scenario considered in (a) above would require Spectrum Five to reduce its peak EIRP level by 21 dB (i.e., 3 – 24), resulting in peak EIRP levels for Spectrum Five of 42 dBW (i.e., 63 – 21). This in turn would reduce the C/I into Spectrum Five (in the scenario assumed in (b) above) by approximately the same amount, to a level of -9 dB (i.e., 12 – 21 = -9 dB, which is a negative value), which is clearly not viable, and evidently does not meet the Spectrum Five proposed interference criterion of 10% increase in unavailability for its own DBS service. Therefore, based on this relatively benign scenario involving an EchoStar CONUS beam satellite, it is impossible to realize the symmetrical interference protection levels proposed by Spectrum Five and SES.

Next, consider the more difficult, but equally important situation of an existing EchoStar spot beam satellite, such as EchoStar-10, which is currently providing local TV DBS service to millions of Americans across the U.S. from the 110°W orbital position. Almost all of the spot beams of EchoStar-10 exceed 60 dBW peak EIRP (some spot beam peaks are higher than 63 dBW), yet certain spot beams need to provide service to the edge of DMAs at EIRP levels of only 50 dBW. Such a high peak-to-edge EIRP ratio is typical of DBS spot beam satellites and is a direct result of the need to provide very high frequency re-use factors, and hence steep gain roll-off at the edge of the DMA's to minimize self-interference to nearby co-frequency spot beams.

Against this EchoStar-10 spot beam satellite we will assume the same Spectrum Five tweener satellite characteristics as discussed above. In this case the following conditions would likely exist across CONUS:

c) Spectrum Five radiates in excess of 63 dBW where EchoStar might be radiating typically 55 dBW. This is an 8 dB EIRP differential in favor of Spectrum Five. Note that 55 dBW

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[21] Note that 24 dB C/I will not necessarily correspond to 10% increase in unavailability in all the situations of EchoStar's DBS service to the different parts of the U.S. service area.

is already 5 dB above the minimum EIRP level for certain EchoStar-10 spot beams, and so is quite likely to correspond to locations that are subject to the peak Spectrum Five EIRP levels in some parts of CONUS.

d) EchoStar-10 radiates in excess of 60 dBW where Spectrum Five might be radiating typically 53 dBW. This is a 7 dB EIRP differential in favor of EchoStar. Note 53 dBW is a mid-range value (across its different spot beams) for Spectrum Five minimum EIRP.

Performing the same analysis as was done above for the case of the EchoStar-8 CONUS beam, we find that, if Spectrum Five was to protect EchoStar to the 24 dB C/I level suggested by Spectrum Five, the resulting C/I level for Spectrum Five would be -13 dB (note this is a negative value), which is clearly not viable, and certainly does not meet the Spectrum Five proposed interference criterion of 10% increase in unavailability for its own DBS service.

One of the factors that Spectrum Five and SES appear to have seriously underestimated is the EIRP differential between the established DBS satellites and the proposed new tweener satellites. Spectrum Five claims to have taken this into account in its analysis, and suggests a value of 4 dB.[22] However, as demonstrated above, EIRP differentials of close to twice this (i.e., ~8 dB) are likely to occur in many situations.

One problematic aspect of the introduction of tweeners into the U.S. DBS environment stems from the fact that a single tweener satellite has to be made as compatible as possible with a number of existing adjacent DBS satellites, each of which has its own individual operating characteristics. Even two CONUS coverage satellites typically have significant EIRP differential in many parts of their service area. For spot beam satellites this situation becomes dramatically worse, as the peaks and troughs of the various spot beams will likely never match

[22] EchoStar does not believe that Spectrum Five has demonstrated any realistic compatibility between tweeners and existing DBS satellites even using this assumption of a 4 dB EIRP differential.

those of another spot beam satellite. At the proposed tweener location of 114.5°W, for example, compatibility would be required with at least six adjacent U.S. DBS satellites. At 110°W (within the ±0.2° cluster) the following DBS satellites are operational: EchoStar-6, EchoStar-8, EchoStar-10 and DIRECTV-5. At the 119°W cluster location the following are operational: EchoStar-7 and DIRECTV-7S. Many of these satellites operate spot beams on certain, but not all channels. Furthermore, the current U.S. DBS operators often have a need to move satellites between orbital locations, such as when new satellites are brought into service or when failures occur on existing satellites. In other words, the adjacent DBS satellite environment is not static, and is certainly not constant across all the DBS channels. This would require that the tweeners have the ability to adapt their characteristics between different channels, and over time as the neighboring satellites are changed. The net effect of all this is that the EIRP differential over the service area cannot easily be maintained to a low level, and any interference assessment of tweeners must take this real-world factor into account.

In conclusion, therefore, it is completely impossible to symmetrically achieve the interference criterion proposed by Spectrum Five and SES Americom if the realities of DBS satellite systems are assumed, including dish mispointing and EIRP differentials. Spectrum Five and SES Americom's proposals for symmetry in this regard are nothing more than pipe dreams, and it is not surprising that there is a distinct absence of any clear demonstration in the FCC submissions by these two parties of how such symmetry might be realized in practice.

A.5 10% REDUCTION IN AVAILABILITY FROM TWEENERS CANNOT BE ACCEPTED IN ADDITION TO OTHER SOURCES OF INTERFERENCE

Both Spectrum Five and SES Americom propose interference criteria into the established DBS operators that correspond to an increase in unavailability not to exceed 10%. It is suggested that such an interference impact would be negligible. This ignores the fact that there are already two other potential sources of interference to DBS satellites – NGSO satellites and terrestrial MVDDS - each of which has already been allowed to degrade the DBS link availability by 10%. The Commission has made it clear in the past that it does not consider it feasible to revisit the

interference allocations made to these services. Indeed, in the case of NGSO satellites, the FCC would be barred from doing so by the ITU's adoption of the 10% criterion. Therefore, if tweener satellites were allowed to further degrade the DBS link availability by 10% as a single entry level, this could amount to a total of 40% increase in DBS link unavailability (assuming two adjacent tweener satellites), which would have significant and potentially serious consequences for the subscribers. Furthermore, if all these interference sources were permitted to compound the interference on each other, the aggregate of all three would be more than 46% overall degradation.[23]

It should also be noted that the use of an interference criterion based on degradation of link availability is most inappropriate for determining interference between two geostationary satellites. Such an interference criterion has been used appropriately in the past only as a necessity when dealing with interference situations that varied significantly with time, such as that due to non-geostationary satellite systems. For an essentially static interference environment, as is the case between tweeners and established DBS satellites, the use of a simple and readily comprehended C/I criterion is much more appropriate.

A.6 19 DB C/I CRITERION IS NOT ADEQUATE FOR 8PSK OPERATIONS

SES Americom has proposed a C/I criterion for interference into established DBS satellites of 19 dB. Such a low C/I level is not adequate to protect the more sensitive transmissions in EchoStar's network, particularly the 8PSK transmissions. 8PSK is rapidly becoming the norm in today's DBS industry, due in part to the rapid introduction of high definition programming, and it is absolutely essential that such transmissions are adequately protected from interference.

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[23] By "compounding" we mean that a new interferor would already take into account existing interference sources when determining the starting link availability of the DBS service, in order to calculate its own 10% contribution to the unavailability. 46% aggregate is calculated by 1.1^4.

High order modulation schemes such as 8PSK are very spectrally efficient and allow the transmissions of higher data rates in the same limited bandwidth. However, the price to pay for the use of such schemes is a higher required C/(N+I) (carrier-to-noise+interference ratio). In the case of 8PSK operating with 5/6 coding, the required C/(N+I) is in the 10 to 11 dB range. Even applying the conventional ITU interference criterion applicable to FSS, which is that the C/I should not be worse than C/N + 12.2 dB, this would result in an FSS C/I requirement of 23.2 dB (i.e., 11 + 12.2), which is significantly higher than the 19 dB proposed by SES Americom. EchoStar believes that additional margin is required above the 23.3 dB C/I level for its DBS services.

CERTIFICATION OF PERSON RESPONSIBLE

FOR PREPARING ENGINEERING INFORMATION

I hereby declare under penalty of perjury that I am the technically qualified person responsible for preparation of the engineering information contained in the foregoing submission, that I am familiar with Part 25 of the Commission's rules, that I have either prepared or reviewed the engineering information submitted in this pleading, and that it is true and correct to the best of my knowledge and belief.

_____/ss/_____

Richard J. Barnett, PhD, BSc
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